## CLAIMS

What is claimed is:

1. In an information transmission system comprising a plurality of elements for generating, transporting, and receiving information, wherein some elements are defective and impose impairments on the information passing therethrough, a method for correcting said impairments, comprising the steps of:
   a) identifying defective elements and characterizing the defect of each;
   b) determining a correction characteristic corresponding to each defective element which, when applied to information passing through said element, corrects the impairment imposed by said element;
   c) formulating each correction characteristic as a composite, two channel I and Q finite impulse response, having I-I and Q-Q direct components and I-Q and Q-I cross components;
   d) combining said correction characteristics of said defective elements into a single correction characteristic comprising two direct and two cross components;
   e) identifying each of the four components of the combined correction characteristics with corresponding direct and cross impulse responses of a generalized two-channel filter;
   f) creating such a filter in accordance with said components of step (e); and
   g) positioning said filter in said information transmission system for correcting said impairments imposed on the information by said defective elements.

2. An information transmission system, as in Claim 1, wherein said system is limited to a data receiver whose elements include an IF filter, a two-channel down-converter, and I and Q data processing channels.

3. An information transmission system, as in Claim 1, wherein said system is limited to a data generator whose elements include I and Q data channels, a two-channel up-converting modulator, and an IF filter.

4. An information transmission system, as in Claim 1, wherein:
   i. step (a) further includes performing a frequency analysis of each defective element;
   ii. step (b) further includes creating a frequency characteristic complementary to said frequency analysis of step (i) such that the combination of said analysis and said complementary characteristic removes the impairment caused by said defective element; and
   iii. step (c) further includes performing an inverse discrete Fourier transform of said complementary characteristic.

5. An information transmission system, as in Claim 1, wherein:
   i. step (c) further includes arranging said direct and said cross components as terms of a set of 2x2 matrices; and
   ii. step (d) further includes arranging said single correction characteristic as terms of a set of 2x2 matrices.

6. A generalized digital filter for filtering two-component signal information, comprising:
   a) a dual input port, having an I input for a signal $x_I$ and a Q input for a signal $x_Q$, wherein $x_I$ and $x_Q$ are components of a two-component input signal x;
   b) a dual output port, having an I output for a signal $y_I$ and a Q output for a signal $y_Q$, wherein $y_I$ and $y_Q$ are components of a two-component output signal y;
   c) a first signal path, characterized by a first impulse response, having an input coupled to the I input port and a first output;
   d) a second signal path, characterized by a second impulse response, having an input coupled to the Q input port and a second output;
   e) a third signal path, characterized by a third impulse response, having an input coupled to the I input port and a third output;
   f) a fourth signal path , characterized by a fourth impulse response, having an input coupled to the Q input port and a fourth output;
   g) summing means for adding said first and second outputs and for coupling the sum thereof to said I output;
   h) summing means for adding said third and fourth outputs and for coupling the sum thereof to said Q output.

7. A generalized digital filter, as in Claim 6, wherein said first, second, third, and fourth impulse responses are independent of one another.

8. A generalized digital filter, as in Claim 7, wherein said first, second, third, and fourth impulse responses are further constrained to have finite lengths.

9. A generalized digital filter, as in Claim 8, wherein said first, second, third, and fourth impulse responses are further constrained to have equal lengths.

10. A generalized digital filter, as in Claim 6, wherein said first, second, third, and fourth signal paths are realized by finite impulse-response filters.

11. A generalized digital filter, as in Claim 10, wherein each of said finite impulse-response filters is independently characterized.

12. In applying a generalized two-channel digital filter to process an input data stream **x** and to produce an output data stream **y**, wherein both **x** and **y** are two-component signals $x_I$, $x_Q$, $y_I$, and $y_Q$ which are processed in blocks of N/2 data values long, N being a power of 2, and wherein the filter is characterized by four independent impulse response vectors $h_{11}$, $h_{12}$, $h_{21}$, and $h_{22}$, each vector of length N/2, a method for efficiently computing said output data stream y, comprising the preliminary steps of:

a) forming the vectors

$$a = \frac{(h_{11} + h_{22}) + j(h_{21} - h_{12})}{2} \quad \text{and} \quad b = \frac{(h_{11} - h_{22}) + j(h_{21} + h_{12})}{2}$$

b) appending N/2 zeros to each vector and performing an FFT on each vector to produce $A_k$ and $B_k$, respectively;

and, for each block of N/2 data values in said input data stream **x**, additionally comprising the iterative steps of:

c) moving the previous block of input data values to the first half of an input vector $x_N$ of length N and loading the current block of input data values into the second half of said input vector $x_N$;

d) treating $x_N$ as a vector of complex numbers of the form $x_I + jx_Q$, and performing a N-point FFT to produce $X_k$;

e) computing the complex vector $Y_k = A_k X_k + B_k X_{N-k}$, $0 \leq k < N/2$, and performing an inverse FFT on the result to produce the complex vector $y_n$;

f) designating the second half of $y_n$ as the N/2 output samples of the current iteration, according to $y_{In} = \text{Real}(y_n)$, $y_{Qn} = \text{Imag}(y_n)$, where $N/2 \leq n < N$; and

g) returning to step (c) for the next N/2 data values.